REMARKS

Currently claims 1-56 are pending in the application. Claims 1-7, 9-25, 27-50, and 54-56 stand rejected as allegedly unpatentable under 35 U.S.C. § 103(a), and claims 8, 26, and 51-53 stand rejected under 35 U.S.C. § 112. Applicants have amended claims 1 and 27 to describe that the methods and systems are used for the quantification of polycarbonate synthesis reactions, wherein the spectroscopic absorbance is correlated to levels of at least one reaction component of interest in a sample of molten polycarbonate polymer and/or oligomer. Applicants have amended claim 52 to more clearly describe the step of using the data collected by the method to optimize the reaction parameters. Support for the amendment is found throughout the specification, *e.g.*, in the Examples, ¶¶ 69-89, and related figures 3-9, describing quantification of Fries in molten polycarbonate, and in the specification at ¶62, describing use of the data from the monitored absorbance to optimize reaction parameters.

The Rejection of Claims Under 35 U.S.C. § 103(a) is Traversed or Rendered Moot

The Examiner rejected claims 1-7, 9-25, 27-50, and 54-56 as allegedly being unpatentable under 35 U.S.C. § 103(a) over U.S. Patent No. 5,657,404 to Buchanan et al. (hereinafter US '404 to Buchanan) in view of U.S. Patent No. 5,857,462 to Thomas et al. (hereinafter US '462 to Thomas). Thus, the Examiner alleged that independent claims 1 and 27, and dependent claims 2-7, 9-25, 28-50, and 54-56, are disclosed by US '404 to Buchanan, with the exception of a data analysis system, and that US '462 to Thomas discloses an analysis system. Office Action at page 2-3.

Applicants respectfully traverse the rejection. As amended, Applicants' claimed invention describes an apparatus for *in situ* monitoring of molten polycarbonate polymer and/or oligomer composition comprising: a light source; a fiber optic transmission probe, wherein said probe transmits at least one substantially monochromatic radiation from said light source to irradiate a molten sample comprising at least one polycarbonate polymer and/or oligomer and collects light transmitted from said irradiated sample; a spectrophotometer, wherein said spectrophotometer monitors radiation comprising UV/visible light absorbed by said irradiated sample; and a data analysis system, wherein said data analysis system correlates absorbance to at least one predetermined reaction

component in said molten polycarbonate polymer and/or oligomer sample. Also, as amended, Applicants' claimed invention describes a method for *in situ* monitoring of molten polycarbonate polymer and/or oligomer composition comprising: providing an optical contact between a fiber optic probe and a stream of a molten sample comprising at least one polycarbonate polymer and/or oligomer; irradiating the molten sample with at least one wavelength of substantially monochromatic radiation; monitoring UV/visible light adsorbed by the molten sample; and correlating the UV/visible light absorbed by the irradiated molten sample to levels of at least one reaction component of interest in said molten polycarbonate polymer and/or oligomer sample.

Thus, Applicants' invention describes methods and an apparatus for in situ monitoring of molten *polycarbonate* polymer and/or oligomer composition *where the absorbance is correlated to at least one reaction component of interest in a molten polycarbonate polymer/oligomer sample.* Applicants respectfully assert that the references cited by the Examiner do not teach the measurement of molten polycarbonate using commercially available probes. In fact, both US '404 to Buchanan and US '462 to Thomas teach away from Applicants' claimed invention.

US '404 to Buchanan describes a heat resistant probe for spectroscopic analysis which is made by controlled conditions in which the optical illuminating and collecting fibers of the probe are sealed to solder plug at the probe tip. See US '404 to Buchanan at 3:52 to 4:26, describing the importance of preparing the solder plug and then inserting the optical fibers, rather than forming the plug around the fibers. US '404 to Buchanan goes on to describe that most commercially available high-temperature probes do not withstand long-term exposure to an inhospitable environment as well as the probe of the claimed invention. US '404 to Buchanan at 5:42 to 6:3. Thus, reading US '404 to Buchanan, one would be discouraged from trying to use commercially available high-temperature probes for on-line, real-time measurement of polymer production.

In contrast, Applicants describe and claim a method and apparatus that uses standard, commercially-available probes in format that allows analysis of molten polycarbonate polymer and/or oligomer composition, where the measured absorbance is correlated to at least one predetermined reaction component in the molten polycarbonate polymer/oligomer. Thus, Applicants' invention describes methods and systems which,

due to the configuration of the system and the use of rigorous data analysis techniques, allow for flexibility in probe design, and do not require the use of a specialized high-temperature probe.

Furthermore, although US '404 to Buchanan describes that the high temperature probe of the invention may be immersed in an inhospitable environment such as that used for polymer formation (see US '404 at 5:41-6:3), there is no description of the nature of the polymer formed, or the spectra obtained. The Examiner stated that support for the measurement of polymers is described by Buchanan at 1:10-13, which is a statement in the background section noting that "[v]arious spectroscopic techniques are routinely used to determine the constitution of chemical compositions and to monitor the progress of chemical reactions and processes." Applicants respectfully assert that this general statement, and the description that the high temperature probes of US '404 can be used to monitor "molten polymer" (see US '404 to Buchanan; Examples) does not describe or teach the measurement of polycarbonate, and polycarbonate reaction components comprising bisphenol A, diphenyl carbonate, uncapped phenolic end-groups, linear Fries products and branched Fries products, using commercially available probes as described and claimed by Applicant.

Thus, there is absolutely no description in US '404 to Buchanan of measurement of polycarbonate products and/or intermediates. US '404 to Buchanan only teaches that the specific probe of the invention is stable to harsh environments for a period of time. Also, there is absolutely no teaching in US '404 to Buchanan as to how one would use standard, commercially available probes for the on-line, real time measurement of molten polycarbonate polymers/oligomers and intermediates. As discussed above, reading US '404 to Buchanan, one would be discouraged from trying to use commercially available probes for on-line, real-time measurement of polymer production

Nor are the deficiencies of US '404 to Buchanan remedied by US '462 to Thomas. US '462 to Thomas describes the application of genetic algorithms for wavelength selection to the measurement of biological materials. The problem addressed by US '462 to Thomas is selection of optimum regions of the spectrum for analysis of a substance comprising multiple analytes, each having a distinct absorbance spectrum. See US '462 to Thomas at 3:45-63, describing the difficulties of wavelength selection for

materials of a complex nature. This is a completely distinct problem from the focus of Applicants' invention. Although US '462 does describe that multivariate search methods may be used to select predictive and synergistic wavelengths (US '462 to Thomas at *e.g.*, 15:35-50 and ABSTRACT), and that multivariate methods may be used for spectral analysis (US '462 to Thomas at 27:39-53) there is no teaching of the application of univariate or multivariate analysis of the quantification of molten polycarbonate polymers, oligomers, or their intermediates. In fact, US '462 to Thomas teaches away from using data analysis that does not employ the genetic algorithm methodology for spectroscopic analysis of mixtures comprising multiple analytes. Thus, US '462 to Thomas states that "[t]he standard method of multivariate processing used 440 wavelength measurements and yielded a SEP of 42.4 mg/dl. In comparison . . . the results obtained by methodology which includes genetic selection utilized only 14 wavelength measurements and yielded a SEP of 21.0 mg/dl", where SEP is described as being related to the size of the calibration residuals. See US '462 at 22:24-29, and 12:1-2.

In contrast to US '462 to Thomas, Applicants do not employ genetic algorithm-based multivariate analysis for wavelength selection. In fact, Applicants' invention describes suitable wavelength ranges for the measurements made by the claimed method and thus, sidesteps the problem addressed by US '462 to Thomas. Nor is there any teaching in US '462 to Thomas of the use of multivariate or univariate data analysis methods for measuring various components in molten polycarbonate samples. Thus, Applicants respectfully assert that US '462 to Thomas does not describe, teach or suggest the application of multivariate or univariate analysis techniques to the quantification of polymer products and/or intermediates.

Thus, Applicants respectfully assert that US '404 to Buchanan, in light of the data analysis systems described in US '462 to Thomas, does not suggest nor enable Applicants' invention, as is required for a determination of obviousness under 35 USC 103(a). *See e.g., Motorola, Inc. v. Interdigital Technology Corp.*, 43 U.S.P.Q. 2d 1481, 1489 (Fed. Cir. 1997) (quoting *Beckman Instruments, Inc. v. LKB Produkter AB*, 13 U.S.P.Q. 2d 1301, 1304 (Fed. Cir. 1989) (holding that in order to render a claimed apparatus or method obvious, the prior art must enable one skilled in the art to make and

use the apparatus or method). There is no description in either of these patents of the application of commercially available probes in combination with specific data analysis systems for the UV/visible measurement of molten polycarbonate polymers/oligomers and intermediates thereof.

Further, the Federal Circuit has held that the totality of a reference's teachings must be considered in finding whether the reference in fact suggests the invention in question, or teaches away from the invention in question. *W.L. Gore & Assocs. V Garlock, Inc.*, 220 USPQ 303, 311 (Fed. Cir. 1983). As described above, reading US '404 to Buchanan, one would be discouraged from trying to use commercially available high-temperature probes for on-line, real-time measurement of polymer production. Also, reading US '462 to Thomas, one would be discouraged from using non-genetic algorithm based multivariate data analysis for the spectral characterization of complex mixtures.

To establish a prima facie case of obviousness three criteria must be met: (i) a suggestion or motivation to modify or combine references; (ii) a reasonable expectation of success; and (iii) all the limitations in the claim(s) must be taught or suggested by the reference, or combination of references. MPEP 706.02(j). Applicants respectfully assert that neither of the references cited by the Examiner alone, or in combination, teach all of the limitations of Applicants' claimed invention. Nor is there any suggestion, upon reading these two references, to combine the references in a way that teaches Applicants' invention. Also, because US '404 to Buchanan teaches away from the use of both standard and commercially available high-temperature UV/optical probes as described by Applicants' claimed invention, and US '462 to Thomas teaches away from using the types of multivariate analysis (*i.e.*, non-genetic based algorithms) used by Applicant, even if there were some motivation to modify or combine the references, there would not be a reasonable expectation of success. Thus, Applicants respectfully assert that these two references do not render Applicants' claimed invention unpatentable under 35 U.S.C. §103(a).

The Rejection of Claims Under 35 U.S.C. § 112 is Traversed or Rendered Moot

The Examiner also rejected claims 8, 26, and 51-53 under 35 U.S.C. § 112. It is unclear, however, whether the Examiner is rejecting the claims as being indefinite under 35 U.S.C. § 112, second paragraph, or for allegedly failing to satisfy the written description requirement under 35 U.S.C. § 112, first paragraph. Thus, after specifically quoting the text of 35 U.S.C. § 112, second paragraph, the Examiner stated:

> Claims 8, 26, and 51-53 are rejected under 35 U.S.C. § 112, *second paragraph*, as containing subject matter which was not *described* in the specification in such a way as to *enable* one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.

Office Action at page 3 (emphasis added). Thus, while specifically stating that the claims are rejected under 35 U.S.C. § 112, second paragraph, the Examiner appears to be citing 35 U.S.C. § 112, first paragraph as the basis of the rejection.

Thus, Applicants respectfully traverse the rejection of claims 8, 26, and 51-53, under 35 U.S.C. § 112, as not being clear with respect to the basis of the rejection as is required under 37 C.F.R. 1.104. Further, Applicants respectfully traverse the rejection of claims 8, 26, and 51-53, under either paragraph 1 or 2 of 35 U.S.C. § 112 for the reasons provided below.

As to claim 8, the Examiner stated that "the specification explains a filter positioned between the sample and the spectrometer, but the claim recites a filter positioned between the light source and the spectrometer." Office Action at page 3. Applicants respectfully assert that the embodiment shown in Figure 1, and described in the specification at ¶¶ 42-45, showing a filter positioned between the sample and the spectrophotometer includes the claimed embodiment of a filter positioned between the light source and the spectrophotometer. Thus, a filter between the sample and the spectrophotometer source is also located between the light source and the spectrophotometer. There is no requirement that the filter must be positioned between the sample and the spectrophotometer; nor does the Specification limit the position of the filter. For example, a filter may also be positioned between the light source and the

sample. Thus, Applicants respectfully assert that a filter positioned between the light source and the spectrophotometer is described and enabled by the specification.

With respect to claims 26 and 53, the Examiner stated that the "claims recite 'computer readable media comprising software code', however the specification does not disclose any detail or description of software code." Office Action at page 3. Applicants' respectfully assert that Examples ¶¶ 69-89 and related figures 5-9, describe the use of computerized analysis systems to develop multivariate models to explain the level of Fries in the measured samples. Also described in the Specification are exemplary computer languages suitable for the applications required in the claimed invention. See the Specification at ¶ 61. Thus, Applicants respectfully assert that the media comprising computer software code as an element of the apparatus, or for performing at least some of the steps of the invention is described and enabled by the specification.

With respect to claim 51, the Examiner stated that "the specification does not disclose any detail or description of 'combinatorial libraries of samples.'" Office Action at page 3. First, the term "combinatorial libraries" is a common knowledge term used by those in the art to describe libraries of samples made using combinatorial chemistry. Also, Applicants specifically describe in the Specification that the apparatus may be used for monitoring polymer samples which are combinatorial libraries of samples dispersed in a 96-well microtiter plate reactor or other type of array. See the Specification at ¶ 49. Also, Applicants show the measurement of multiple samples that comprise combinatorial libraries. For example, the data in Figure 4 and 7, show the measurement of 46 samples having variable concentrations of Fries, and the data in Figure 5 describes measurement of 50 different samples. See the Specification at ¶¶ 69-80, and Figures 4, 5 and 7. Thus, the apparatus and method of the invention has been applied to libraries of multiple (n=46; n=50) samples having various concentrations of the analyte of interest. These collections of samples comprise, to Applicants' understanding as researchers in the field of combinatorial analysis, combinatorial libraries. Thus, Applicants respectfully assert that measurement of samples in combinatorial libraries are described and enabled in the specification.

As to claim 52, the Examiner stated that "the specification does not disclose any detail or description of 'applying a predetermined selection test'". Office Action at page 3. Applicants have amended claim 52 to more clearly describe the step of using the data collected by the method to optimize the reaction parameters as comprising the step of "evaluating the monitored absorbance to determine whether any one of a set of preselected reaction components needs to be adjusted." Applicants respectfully assert that this type of evaluation is described and enabled by the Specification. For example, the Specification describes that:

> [T]he invention comprises methods and devices for the noninvasive monitoring of polymer formation using UV/visible absorbance spectroscopy. The method further contemplates the use of univariate and multivariate analysis for determining changes in levels of reaction components of interest as polymerization proceeds. The invention permits determination of Fries products formed during the melt polymerization process, and using that information to adjust reaction parameters, thereby optimizing polymer production.

The Specification at ¶ 62. The specific reaction parameters will of course necessarily vary with the application or process being monitored.

Thus, for at least these reasons, Applicants respectfully traverse the rejections of claims 8, 26, 51-53 under 35 U.S.C. § 112, and assert that the claims are in condition for immediate allowance.

VERSION SHOWING CHANGES MADE

In accordance with 37 CFR 1.121, the following version of the claims as rewritten by the foregoing amendment show all the changes made relative to the previous versions of the claims, with additions underlined and deletions [bracketed].

1. (Amended) An apparatus for *in situ* monitoring of molten polycarbonate polymer and/or oligomer composition comprising:

a light source;

a fiber optic transmission probe, wherein said probe transmits at least one substantially monochromatic radiation from said light source to irradiate a molten sample comprising at least one polycarbonate polymer and/or oligomer and collects light transmitted from said irradiated sample;

a spectrophotometer, wherein said spectrophotometer monitors radiation comprising UV/visible light absorbed by said irradiated sample; and

a data analysis system, wherein said data analysis system correlates absorbance to at least one predetermined reaction component in said molten polycarbonate polymer and/or oligomer sample.

27. (Amended) A method for *in situ* monitoring of molten polycarbonate polymer and/or oligomer composition comprising:

providing an optical contact between a fiber optic probe and a stream of a molten sample comprising at least one polycarbonate polymer and/or oligomer;

irradiating the molten sample with at least one wavelength of substantially monochromatic radiation;

monitoring UV/visible light adsorbed by the molten sample; and

correlating the UV/visible light absorbed by the irradiated molten sample to levels of at least one reaction component of interest in said molten polycarbonate polymer and/or oligomer sample.

52. (Amended) The method of claim 27, further comprising evaluating the monitored absorbance [applying a predetermined selection test] to determine whether any one of a set of preselected reaction components needs to be adjusted.

CONCLUSION

In view of the foregoing amendment and remarks, each of the claims remaining in the application are in condition for immediate allowance. Accordingly, the Examiner is respectfully requested to reconsider and withdraw the outstanding rejections.

The Examiner is respectfully invited to telephone the undersigned at (336) 747-7541 to discuss any questions relating to the application.

Respectfully submitted,

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